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NAME OF SUPERVISOR/NOM DU DIRECTEUR DE THÈSE DR. DAVID W. GILLEN

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THE UNIVERSITY OF ALBERTA

DEVELOPMENT STRATEGY FOR LABRADOR'S NATIVE POPULATION: THE CASE OF COMMERCIAL FISHING

by

© JAMES BAXTER JONES

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF ARTS

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Development Strategy for Labrador's Native Population: The Case of Commercial Fishing submitted by James Baxter Jones in partial fulfillment of the degree of Master of Arts.

David W. Fuller
Supervisor

Melville McMillan

Lloyd S. Smith

Date August 24/76

ABSTRACT

This thesis is an attempt to analyze, through cost benefit analysis, a commercial fishing project in central Labrador that is designed to create employment for some of the native Indians of Labrador.

First, the problem of widespread native unemployment is considered. The study traces the non-development of Labrador, through location theory, and concludes that the natives rejection of European culture coupled with the non-utilization of native labour by Europeans have left the natives of today without the required technical skill or work discipline necessary to find employment. The events that led to the development of the Churchill Falls power project and the creation of the Smallwood Reservoir, on which fishing will take place, are discussed along with a detailed description of the fishing project.

Second, technical problems such as overfishing are discussed in light of the basic theory presented by Gordon in 1954. To preserve the fish stocks and ensure consistent growth patterns, the fishery at Churchill Falls has a limit on the number of fishermen

and the fishing technology such as net mesh sizes.

Finally, the costs and benefits of the project are determined and compared on three different levels; the governments (provincial and federal); the Indians; and the economy. It is determined that, subject to certain assumptions, benefits exceed costs for all levels. The assumptions on which the costs and benefits are based are then discussed in light of their validity with regard to this fishing project.

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A number of individuals deserve recognition for their aid in the completion of this thesis.

My thanks go out to William Bruce for providing the problem and the biological data to go along with it, and to Melville McMillan for reading early drafts of the thesis and correcting and clarifying numerous points.

Special recognition should go to my supervisor, Dave Gillen. Dave, to say thanks would only cheapen the gift.

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CHAPTER I

INTRODUCTION

The native people (Indian and Eskimo) of Labrador whose population is approximately 3,000[1] live along the coastline of Labrador. In past generations the natives lived by hunting, trapping, and fishing, but for most of the present generation there is nothing but chronic unemployment and a subsistence based on government welfare.

This thesis analyzes a particular project which can create long term employment for a specific group of natives. The project analyzed is a commercial fishing venture on the Smallwood Reservoir in Central Labrador and its purpose is to provide some of the 900 residents of the Montagnais Indian Band of North West River with long term employment.

The thesis begins with an historical look at Labrador and gives reasons why it did not attain a high level of economic development.

Chapter II also examines why the natives (particularly the Indians) are today suffering from high unemployment. The historical events that led to the

creation of the Smallwood Reservoir at Churchill Falls are also described. The chapter ends with a description of the fishing project, its objectives, and means to achieve those objectives.

Chapter III discusses some of the technical problems which may affect the fishing project. The chapter begins with a discussion of fishery economics and its applicability to the fishing project. The analysis revolves around the problem of possible overfishing and what can be done to avoid it. Lastly, the chapter reviews the biological relationships, as determined by Environment Canada, that are characteristic of the fish stocks in the Smallwood Reservoir. The composition of catch, the breakdown in catch per mesh size, and the catch per unit effort are all discussed along with an estimation of the total expected catch and the maximum sustainable yield level of fishing effort.

Chapter IV is a cost benefit analysis of the fishing project. The analysis starts with six Indians fishing over a time horizon of four years. The economic costs and benefits of establishing the fishery that accrue to the Indians, the governments (provincial and federal) and the economy as a whole are

determined and compared. Given that for six fishermen benefits exceed costs, then possible increases in the number of fishermen is discussed. Any possible indirect effects of the project are also discussed but not quantified.

Chapter V examines the possibilities that the estimated costs and benefits of Chapter IV are not accurate. The chapter also describes an alternate design for the project which could provide the economy with a more efficient allocation of resources. Lastly, a recommendation is made that future projects, similar to the project described in this thesis, be designed along the alternative guidelines presented in Chapter V.

CHAPTER I

FOOTNOTES

[1]Statistics Canada, Census Division, 1971.

CHAPTER II

THE HISTORICAL BACKGROUND

Introduction

The purpose of this chapter is to provide background information on the project analyzed in the following chapters. It begins with a discussion of location theory and regional development and the reasons why Labrador, as a region, has not followed the developmental pattern of location theory. The effects that this non-development has had on the native population are also discussed. The historical scenario which affects the project is described. Finally, a description of the project and its final goals are discussed.

2:1 Review of Regional Development Theory

There are two basic approaches to the development of regions, location theory (Isard, Hoover and so on) and the export base theory propounded by D. C. North.[1]

Location theory maintains that development occurs in stages at the site of natural resources. The first stage which lays the basis for the settlement of a region is self-sufficiency. The settlers are able to support themselves without capital, technology, or trade from outside the region. Over time contacts with the outside world develop.

These contacts may be purely accidental or planned.[2] Through these initial contacts, a system of transport networks will develop. Trade is the concomitant of these networks. As trade develops the region will produce commodities in which it has comparative advantage and may obtain other foods in return. A region will produce, for export, that product which provides for the best allocation of the resources available to the region and which maximizes regional income. The emphasis has now shifted from a subsistence economy to a trading economy.

"Diminishing returns" force the region to look to new ways of maintaining its comparative advantage in producing export products. This usually comes in the form of new technologies (capital or labour-saving techniques). Associated with this basic export product and with the new technologies is the idea of backward and forward linkages. New secondary industries develop to further serve the main staple product of the region. Tertiary or service industries also develop to serve the people of the region. Now the region has become industrialized and indeed the original importance of the export staple may be lost to the secondary and tertiary industries.[3]

D. C. North contends, however, that the stages

of development just discussed do not really apply to North America.[4] He maintains that the above theory was developed with reference to European regions. North American regions were settled to provide natural resource exports for Europe and not, as location theory suggests, for self-subsistence. When the western world was discovered it produced primarily fish for European markets.[5] North developed what he called an export base theory; that is, regions were first settled for purposes of trade. Also any further economic expansion of the regions revolved around the natural resources being exported. The initial stimulus from the primary industry would lead to secondary and tertiary industries.

The difference in the two approaches, however, has been adequately settled by Charles Tiebout.[6] In the case of North America, says Tiebout, the regions just didn't go through all the stages, and North's export base theory is equivalent to stages of development in location theory (from the second stage on). Thus, location theory includes the export base theory of North, but for the regions of North America only the latter part of the theory applies.

2:2 Labrador as a Region

Over the centuries the native people of Labrador (Indian and Eskimo) have developed a distinct culture and tradition. Their main source of survival was hunting, trapping, and fishing. This could be considered the self-subsistence stage in location theory.

It is generally thought that the first white men to see Labrador were the Vikings in approximately the year 1,000 A.D. However, no permanent settlements appeared. After John Cabot's discovery of Newfoundland in 1497, many fishing fleets from Britain, France, Spain, and Portugal came to the coast of Labrador in the summers.[7] While there were no permanent settlements until a couple of centuries later, extensive contact was made with the natives. For the natives this is the beginning of the second stage of location theory.

From this initial stimulus, location theory suggests that Myrdal's cumulative causation (that is, an upward economic spiral) would precipitate development. The establishment of primary industries would lead to secondary and tertiary industries and increase the levels of welfare in the region.

In Labrador's case, however, the theory attenuates after this initial contact. Even though communication

networks to outside regions were opened and trade and exchange of technologies took place, the natives (particularly the Indians) did not become involved in the European culture. They made use of the European technological innovations and capital equipment (such as guns, boats, and so on) in their hunting and fishing, but the Europeans did not need the native labour in their production of fish, nor did the natives seek employment in the European ventures. The main reason for which is because the natives did not pursue the ocean fishery extensively. They engaged mainly in inland fishing and hunting.[8] The natives maintained their independence and Myrdal's cumulative causation appeared as a downward spiral impeding any further development.

The Labrador fishery, itself, operated on a "floater" type operation.[9] The "floaters" were fishermen who, in earlier years came from Europe and in later years from the island of Newfoundland to the coast in the summer, fished, and left (usually after 5 to 5½ months) with their catch at seasons end.[10] The "floaters" did not need any permanent processing facilities because the fish were preserved in salt aboard the ships. Because of the type of fishing, no primary industries (and the backward and forward linkages involved therein) developed along the coast. Whether the natives' rejection of European culture

was the cause or effect of little economic development in Labrador is inconsequential to this analysis. The important thing is that the natives lived within and maintained their traditions and consequently had neither the discipline nor the technical training to participate in an industrial sector in later years.[11] Eventually, the rich resource base of the fishery became depleted and the Labrador fishery virtually came to an end.[12] When the natives' old method of livelihood had failed them, both the "floaters" and the fish were gone and the natives could not turn to the fishery for developmental opportunities.[13]

Meanwhile, Labrador has become one of Canada's most prized possessions with the development of its great wealth of natural resources. The region contains the rich iron ore deposits at Labrador City/Wabush, the immense hydro-development at Churchill Falls, the proposed development of the lower Churchill River, untold reserves of oil and natural gas, and prosperous forest stands.

Yet among the riches lies widespread poverty. The natives, who have become partially integrated into a culture they rejected earlier, suffer from severe unemployment and lack of public services. Because the native

population (approximately 3,000)[14] is scattered along the coastline of Labrador, the cost of public services such as health and education is extremely high and, given the financial constraints of the provincial government, the level of service is consequently low. This lack of educational opportunity, coupled with the original rejection of it, has left the native people without adequate technical skill required for employment in Labrador's modern natural resource sector.[15]

What can the natives do to expand their economic base? Gerhard Anders contends that for most of Canada's natives to escape their poverty total acculturation with western society is necessary.[16] However, Anders points out, certain natural resource projects like the fishing in Great Slave Lake could provide the natives with a comfortable living that is commensurate with their old traditional methods. With the completion of the Churchill Falls power project, an opportunity has developed for the Indians of Labrador to find employment in a fishing project similar to that at Great Slave Lake. This opportunity, however, has been available for only a few years.

2:3 A Brief History of Labrador

In the history of Canada, the battles of the French and English over control of the land is well documented, and Labrador is no exception. Under the Treaty of Paris (1763), which acknowledged the French defeat, the coast of Labrador was granted to Newfoundland.[17] This was accepted and Newfoundland fishermen continued to fish the coast.

However, in the late 1890s Quebec, a province of Canada, contested this treaty as to what represented the coastline of Labrador.[18] Quebec argued it was just the coastal waters that Newfoundland, at that time not a part of Canada, had a right to. The Newfoundland government contended that the coast represented much more than that. They argued that the word "coast" could represent the word country, in the same manner as is often times in the Bible.[19]

Eventually, Canada and Newfoundland took the case to the Privy Council in London which, under the British North America Act, had powers to determine such conflicts. The Privy Council met in 1929 and decided in favour of Newfoundland.

It said:

> The boundary between Canada and Newfoundland in the Labrador Peninsula is a line drawn due North from the Eastern Boundary of the bay or harbour of Ance Sablon as far as the 52° North Latitude, and thence West along that parallel to Romaine River, and then North along the East Bank of that river and the head waters to their source, and then due North to the crest of the watershed, and West of North along the crest of the watershed of rivers flowing into the Atlantic up to Lake Chidley.[20]

This means the west boundary of Labrador and Quebec follows the separation of drainage areas. This was to play a very important part in the future of Labrador and indeed is a major factor why the project analyzed in this thesis became possible.

2:4 Brinco Development

In the early 1950s the Newfoundland government realized the potential wealth of Labrador. Premier J. R. Smallwood, backed by Prime Minister Winston Churchill of Britain, set up the British Newfoundland Corporation (henceforth BRINCO) to develop the resources of Labrador. BRINCO, financed by the Rothschilds, Prudential Insurance, and others, was granted mineral and water rights to 130,000 sq. km. in Labrador.[21] BRINCO's exploration in Labrador revealed one important find. A good deal of

the watershed in western Labrador emptied into one major river, the Hamilton (renamed the Churchill in honour of the British Prime Minister). Also, in a distance of a few kilometers the river drops 322 meters, included in this is the 75 meter drop of the Hamilton or Grand Falls (henceforth the Churchill Falls).[22] This provided tremendous potential for power development. The end result of BRINCO's efforts has been the development of a huge hydro plant and the creation of the 7020 sq. km. Smallwood Reservoir.

2:5 Description of the Fishing Project

The project, a joint venture of the Indian Band Councils of Davis Inlet and Northwest River (henceforth IBC) provincial and federal governments, involves commercial gillnet fishing by the native people on the Smallwood Reservoir.[23]

The IBC approached the Labrador Services section of the Department of Rehabilitation and Recreation of the Province of Newfoundland and Labrador with their proposal and won assurance of financial support. Co-operation was also obtained from the Churchill Falls (Labrador) Corporation (henceforth CFLCO), a subsidiary of BRINCO, who under agreement with the provincial government, held water rights in the area. CFLCO offered moral support

to the IBC. To obtain further fundings the IBC approached Canada Manpower. Through its Local Employment Assistance Program (LEAP) further fundings were obtained. LEAP has provided finances to carry out a six-month developmental phase. Then, subject to LEAP approval, finances for three years are available. After this it is hoped the project can be self-sustaining.

The agreement is as follows:

-- the provincial government will provide all initial capital equipment needed for the fishery, the cost of transporting the fishermen to the site, and take care of marketing the produce.

-- the federal government (through LEAP) will pay salaries to the fishermen and to the co-ordinator plus other contingency costs.

-- the revenues from production will go back into the project to pay for new equipment, and so on.

-- the Indians will be responsible for their own welfare (food, and so on) and the buying of new equipment.

For the developmental phase six fishermen will fish the reservoir. These six fishermen, all from the Montagnais Band at Northwest River, will be flown to Churchill Falls (some 241 km) and live in tents for the duration of the fishing season. The fishing season runs from approximately mid-June to late October. At the end

of the season (at freeze-up) the Indians will hunt and trap in the area until the beginning of the next fishing season. The hunting and trapping during the off-season is not a part of the project. The idea to hunt and trap was purposed by the Indians for which they receive no funding and, thus, will not be considered in this analysis. Through the LEAP agreement each fisherman will receive a salary of $125.00 per week.

They will fish in groups of two using ten nets per group. The co-ordinator will receive $250.00 per week. The purpose of the co-ordinator is to provide constant monitoring of the project (that is, fish catch statistics, and so on).

The fish produce will be gutted immediately upon capture and stored in cooling units. The fish will then be shipped to markets in the Montreal area, either by air or ground transportation.

At the end of the six-month developmental phase the program will be reviewed by Canada Manpower. If LEAP officials are satisfied with the results of the developmental phase, the project will be funded as a full project (that is, three years). After four fishing seasons (the developmental phase plus three project seasons) no further fundings will be available and the project will

either support itself or end.

The aim of LEAP programs is to provide initial capital involved in starting work projects in areas or with groups that do not have access to such finances themselves. LEAP operates mainly in underdeveloped or underemployed regions and has the goal of initiating long-term employment. At present the Indians are unemployed and receiving welfare assistance. The aim of the governments is to provide a stimulus to help create long-term employment for these people.

CHAPTER II

FOOTNOTES

[1]E. M. Hoover, The Location of Economic Activity (New York, McGraw-Hill, 1948) and Walter Isard, Location and Space Economy. (Cambridge, MIT Press, 1956) and D. C. North, "Location Theory and Regional Economic Growth" in Journal of Political Economy. (Vol. 63, 1955), pp. 243-258.

[2]An example of accidental contacts would be a lost ship at sea stumbling on an unknown island. A planned contact would be exploration.

[3]Inherent in location theory is Myrdal's cumulative causation. Gunnar Myrdal, Economic Theory and Underdeveloped Regions (New York, Harper and Row, 1957), Chapter 2. The exports occurring in the second stage of the theory causes an upward economic spiral that leads to industrial development.

[4]D. C. North, op. cit., pp. 243-258.

[5]Harold A. Innis, The Cod Fisheries (New Haven, Yale University Press, 1940). Innis maintains " . . . North American economic development was powerfully directed toward concentration on staples (the first staple being codfish) for export . . . ."

[6]Charles M. Tiebout, "A Rejoinder" in J. Friedman and W. Alonso (eds.), Regional Development and Planning (Cambridge, M.I.T. Press, 1964), p. 265.

[7]Innis, The Cod Fisheries, pp. 11-13.

[8]V. Tanner, Newfoundland—Labrador (University of Helsingfors, 1944), pp. 582-682.

[9]Ibid., p. 748

[10]P. Copes, The Resettlement of Fishing Communities in Newfoundland (Ottawa, Canadian Council on Rural Development, 1972), p. 228.

[11]P. Copes (1972) shows the average number of years of formal education per person over five years in Labrador is 5.416 years, and an excellent study of the native work problem is Gerhard Anders. "On the Economic Development of Canada's North West Territories" (Ph.D. thesis, Texas A and M University, 1972)

[12]P. Copes (1972) Table 50 shows the productivity of inshore fishermen decreased from 18,099 kg. per fishermen per year in 1956 to 11,250 kg. per fishermen per year in 1970. Given the decrease, the marginal product of fishermen must have decreased even more. In Labrador's case, since the fishery has been virtually abandoned, at any fishing effort it is quite conceivable that marginal revenue, a monotonic transformation of marginal product at a fixed price, is less than marginal cost.

[13]With the introduction of synthetic materials in the early 1900s, the demand for fur dropped. Thus, trapping, which formed a large part of the natives' incomes, could no longer support them. See Harold A. Innis, The Fur Trade in Canada, Revised Edition, (Toronto, University of Toronto Press, 1956) and Keith J. Crowe, A History of the Original Peoples of Northern Canada. (Montreal, Arctic Institute of North America, 1974), pp. 110-115.

[14]Statistics Canada, Census Division, 1971.

[15]The result is that the natives are not employed in the industrial centres of Labrador. In both Labrador City (Wabush) mining towns and Churchill Falls the work force consists almost totally of non-indigenous people.

[16]Anders, On Economic Development, pp. 65-68.

[17]P. W. Brown, Where the Fishers Go (the Story of Labrador) (Toronto, Musson Book Company, 1909), p. 42.

[18]J. R. Smallwood (ed.), The Book of Newfoundland (St. John's Newfoundland Book Publishing, Ltd., 1967), pp. 1-14.

[19]Philip Mathias, Forced Growth (Toronto, James Lewis and Samuel, 1971), p. 71.

[20]C. R. Fay, "Newfoundland and Labrador Potential" in Canadian Journal of Economic and Political Science (Toronto, University of Toronto Press, 1953), p. 457.

[21]P. Mathias, Forced Growth, pp. 48-49.

[22]P. Mathias, Forced Growth, p. 53.

[23]The information contained herein was gathered by the author in the summer of 1975. The IBC, provincial and federal governments have all contributed.

CHAPTER III

APPLIED FISHERIES ECONOMICS

Introduction

This chapter reviews the basic postulates of the theory of fishery economics and its applicability to the Churchill Falls fishery. Section 1 discusses the basic propositions of the theory and concludes that restriction on entry is a necessary constraint to avoid depletion of the resource base. Section 2 reviews the age and growth patterns of the fish stocks in the Smallwood Reservoir that determine the size and stability of fish catches. This section concludes that limitation of mesh sizes is a necessary constraint for a consistent growth rate of the fish population.

3:1 Basics of Fisheries Economics

The fishery which is a renewable natural resource can be analyzed with the tools of economics. However, the biological aspects of the fishery have to be integrated with the standard economic tools.

The theory of fisheries economics is a field which has only recently developed. Fisheries economics must account for this natural resource which has properties

unique from other natural resources.[1] The fishery, oil and gas reserves, and water resources are examples of natural resources which are similar in their common property nature and their possibilities of depletion (which arise from the common property nature). The fishery is unique because of the short time period needed for the natural reproduction of fish stock.

The idea of uniqueness of the fisheries was stated in principle by Alfred Marshall.[2] Marshall maintained that the conventional law of diminishing returns does not directly apply to the fisheries but works through the biological phenomenon that increased fishing effort leads to a reduction in fish stocks. In other words, the catch per unit of effort will decrease when fishing effort is greater than a certain level. This proposal was accepted by economists until 1952 when Scott Gordon asserted that Marshall misinterpreted the law of diminishing returns when considering the fisheries.[3] Gordon stated that Marshall's misinterpretation was based on the idea that the law of diminishing returns works through a population reduction. Gordon says that the biological phenomenon of a population reduction is totally independent of the law.[4] From this original work came Gordon's seminal work which launched the theory of fisheries economics.[5]

Gordon's basic model is[6]

(1) $P = P(L)$ where P is fish population.

(2) $L = L(P,E)$ where L is total of quantity of fish landed.

(3) $C = C(E)$ where E is the intensity of fishing effort and C is the total cost.

The model contains two characteristics which distinguish it from standard neoclassical theory. The first difference (and it has been a area of controversy) is equation (2). Gordon maintains that the law of diminishing returns does not apply to the fishery. The law of diminishing returns states that if increasing quantities of a variable factor are applied to a given fixed factor, the marginal product of the variable factor will eventually decline.

In equation (2), however, if fishing effort is varied, the population cannot remain constant. To illustrate this the concept of maximum sustainable yield must be introduced. Maximum sustainable yield is the maximum yield of fish that can be taken from a stock yet maintain the population stock constant. At maximum sustainable yield the natural reproductive rate of fish population equals the natural death rate plus the total amount of

fish landed. For any particular stock of fish, there is a maximum annual yield that can be sustained over time. Fishing effort beyond maximum sustainable yield leads to lower sustainable yields in the future (depletion on overfishing) because fish landings plus natural mortality exceed the natural reproduction rate. Fishing effort less than maximum sustainable yield is underfishing because employment of greater effort will produce higher sustainable yields. Underfishing occurs because natural reproduction exceeds landings plus natural mortality, and the population can withstand greater efforts. The point at which the natural reproductive rate equals landings plus natural mortality is the maximum of all sustainable yields. If depletion occurs the population is decreasing whereas if underfishing occurs the population is increasing.[7] Thus Gordon maintains that the law of diminishing returns does not apply because fish population cannot be held constant while increasing fishing effort. Hence, the marginal physical product will eventually decline because of biological relationships and not economic ones.

In the case of a fishery with unrestricted entry, the condition that total revenue equals total cost (i.e. price x landings = cost) is required for stability.[8] Fishermen operate where average revenue equals average total costs because of the common property nature of the

fishery. The main characteristic of common property resources is that the only way it can become private property is through capture.[9] If fishermen are operating where average revenue equals average total cost they are just breaking even, but they are taking catch in excess of that which they would take if they operated at the economic optimum. The economic optimum requires fishermen to operate where marginal revenue equals marginal cost. However, by operating at the economic optimum, the fishermen are not taking the greatest catch possible. Fishermen are concerned with total catch because the fish that they leave behind is of no value to them. The fish may not be there in the future. Thus by equating average revenues and average total costs fishermen are taking greater catches than they would if they equated marginal revenue and marginal cost.

However, it is quite possible that by fishing where average revenue equals total cost, they are taking catch in excess of the maximum sustainable yield level and thereby depleting the fish stocks.

From Figure 1 for a given price (i.e. this is just a small fishing area), the total revenue curve is a monotonic transformation of the total product curve.

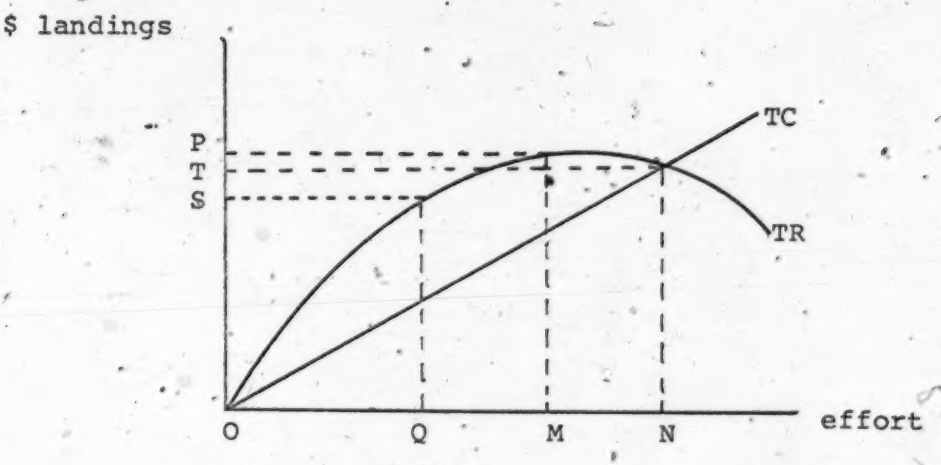


FIGURE 1

A fishing effort of OM generates total revenue of $OP. This is the maximum sustainable yield in dollar terms. However, in an unrestricted fishery, TC = TR is a necessary and sufficient condition for stability, fishing effort will be ON and total revenue $0T. This is less revenue than can be earned from somewhat less fishing effort (for example, OM) but is more revenue than can be earned from the economic optimum fishing effort (OQ) at which MR = MC. A fishing effort of ON is over-fishing and leads to a reduction in fish stocks.

Gordon concludes that to prevent the resource from depletion restriction on entry has to be imposed. Fishing effort should not be allowed to exceed the maximum sustainable level of OM.[10]

The above analysis and conclusions have important

ramifications for the Churchill Falls fishery. Fishing effort should not be allowed to exceed that level which, in the strict biological sense, leads to the maximum sustainable yield. There is a definite benefit in limiting the number of fishermen; to maximize the future profits from the fishery. If the limit is exceeded the end result is a decrease in fish stocks and a decrease in profits from the fishery.

3:2 Biological Studies on the Smallwood Reservoir

Environment Canada, Fisheries and Marine Services, have conducted a number of surveys on some of the natural lakes that make up the Smallwood Reservoir. There are seven natural lakes (Sail, Orma, Michikamau, Lobstick, Sangrit, Jacopie, and Ossokmanuam). For the development phase the Indians will fish Lobstick Lake (see Fig. 2), although fishing in other areas will likely occur as the project expands.

There are two main control structures on the reservoir. The structure at Lobstick controls water flows of the whole reservoir into Jacopie Lake. The structure at Jacopie controls the water levels in Jacopie Lake (the immediate store of water for the power installation). The Lobstick structure is approximately 108 km. from the townsite of Churchill Falls to the east and 140 km. from the Quebec North Shore and Labrador railway lines

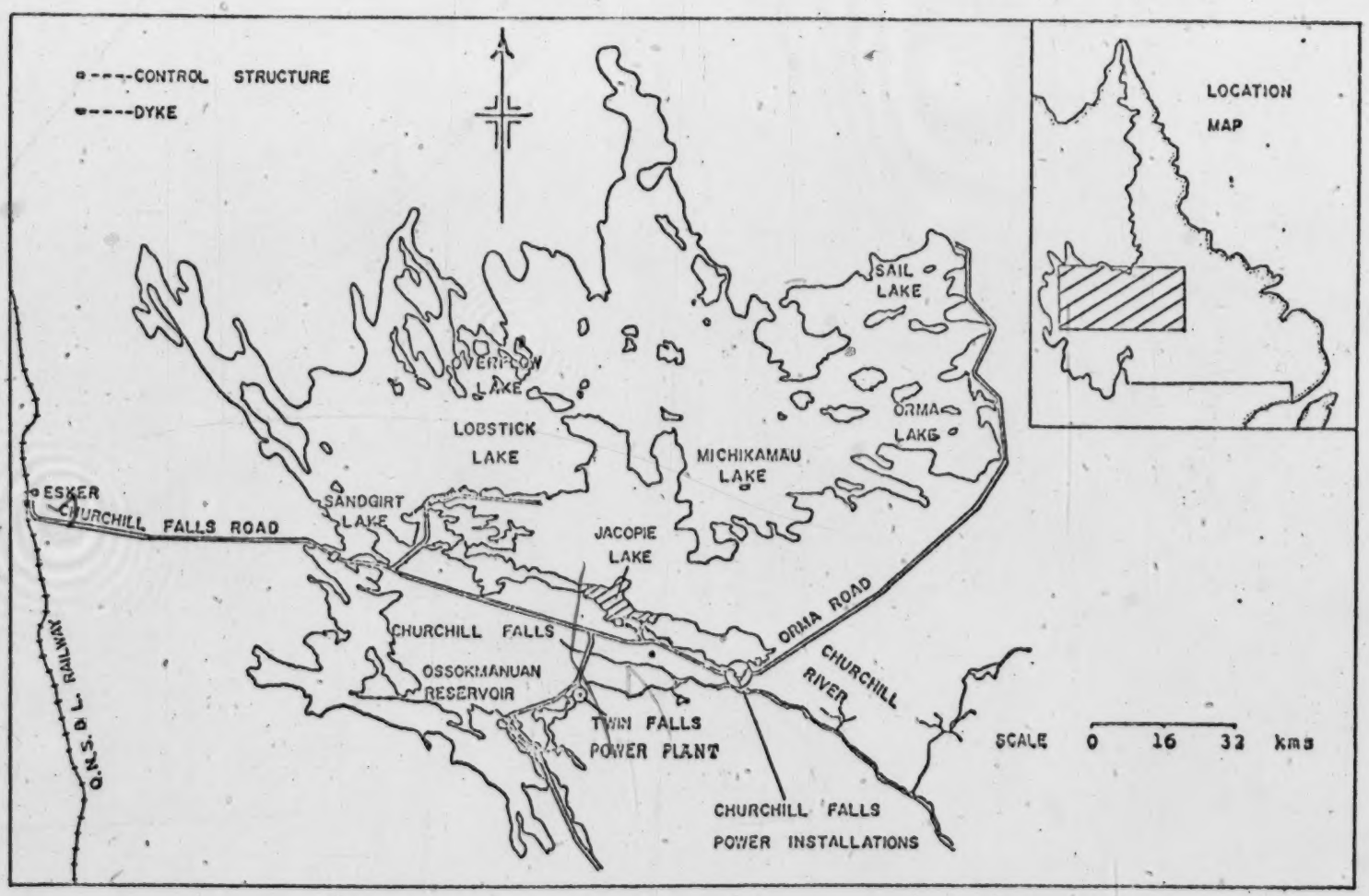


Fig. 2. Smallwood Reservoir, Labrador

(henceforth QNS and L) at Es[illegible]r to the west. It is at the Lobstick structure that the six fishermen will be located during the fishing season.

In the summer of 1974, Environment Canada investigated the biological aspects of fish populations in the Lobstick area.[11] There are nine species of fish in the Lobstick area.[12] Of the species, lake whitefish was the most abundant and also the most commercially feasible.[13]

The survey was conducted using gillnets of five different mesh sizes. The stretched mesh sizes were 3.8, 5.0, 7.6, 10.2, and 12.7 cm. Each net of different mesh sizes is 45.5 meters long. The survey showed that 75 per cent of total catch in terms of weight were caught in the three largest mesh sizes. The survey also showed that the young fish (less than five years) were taken in the 3.8 and 5.0 cm. mesh.

Given this information, Environment Canada, stressed the importance of limiting mesh sizes to a minimum of 7.6 cm. The smaller mesh sizes would catch the young fish and this would lead to restrictions in the growth of fish stocks.[14]

Thus, to preserve the young and immature fish, mesh size is restricted to a minimum of 7.6 cm. This will not lead to a great loss in terms of weight since the two smallest mesh sizes accounted for only 25 per cent of total

weight. This restriction will stabilize catches and hence future incomes of the fishermen.

The catch per unit effort recorded by Environment Canada was 18.76 kg/100 meters/24 hrs. for the three largest mesh sizes. This catch was comprised of 60 per cent whitefish, 31 per cent lake trout, and 9 per cent other species. For the purpose of this analysis, the assumption is made that the Indians can achieve the efficiency of Environment Canada and record a similar catch per unit effort. There is no evidence to suggest that this assumption is unreasonable.

The six fishermen will fish in groups of two using ten nets per group. Each net consists of three different mesh sizes. Each mesh size is 45.5 meters long. Thus, each group will use 136.5 meters per net or a total of 1365 meters per day.[15] The total catch will be 256.07 kg/day.

The fishing season lasts from mid-June to mid-October. This is approximately 18 weeks. It is not unreasonable to assume that fishermen can work six days a week. This is a total of 108 days per season. Therefore, the annual catch for a group of two is 27,655.5 kg.

Environment Canada estimates the maximum sustainable yield of the reservoir at 454,545 kg. Given present fishing technology, the maximum number of groups fishing

is 16 (or 32 fishermen). If this total is exceeded, then the fisheries of the Churchill Falls Reservoir will become depleted and the chances of maintaining a permanent fishery will become remote.

3:3 Summary

The two main ideas from this chapter, the restriction of entry and the limitation of mesh sizes, are necessary for the cost-benefit analysis that follows in the next chapter. The restriction of entry and limitations of mesh sizes both affect the revenues received from the fishery and these revenues are one of the main benefits of the fishery.

CHAPTER III

FOOTNOTES

[1]The theory applies to inland and ocean fisheries.

[2]Alfred Marshall, Principles of Economics (London, MacMillan and Co., Ltd., 1938), p. 166.

[3]H. Scott Gordon, "On a Misinterpretation of the Law of Diminishing Returns in Alfred Marshall's Principles," in Canadian Journal of Economics and Political Science (February, 1952), pp. 96-98.

[4]Ibid., pp. 97-98. "The assumption is made that the size of the natural resource factor is constant. Thus the law is theoretically incompatible with any statement concerning changes in the size of the natural resource."

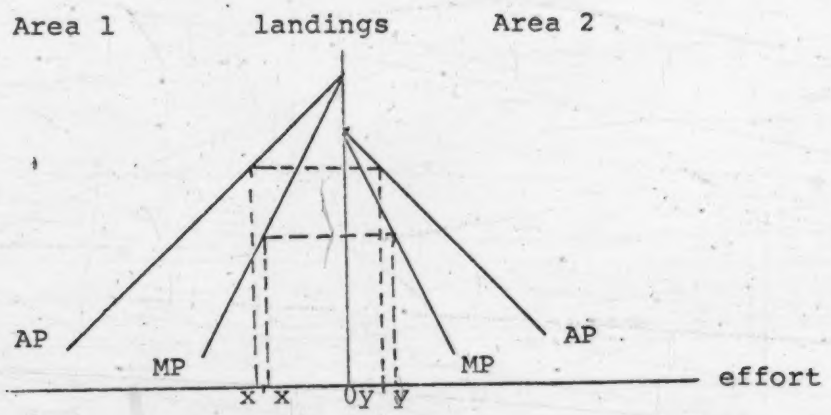
[5]H. Scott Gordon, "The Economic Theory of a Common Property Resource: The Fishery," in Journal of Political Economy (April, 1954), pp. 124-142.

[6]Gordon, Journal of Political Economy, Arguments which follow are taken from this article unless otherwise noted.

[7]Francis T. Christy, Jr., Alternative arrangements for Marine Fisheries: An Overview (Washington, Resources for the Future, Inc., 1973), pp. 9-16.

[8]Gordon, Journal of Political Economy, shows that fishermen are concerned, not with marginal products, but with average products since it is average product which determines average total yield.

(Footnote 8 Continued)



The optimal fishing on both areas would be where $MP_1 = MP_2$ (i.e. OX effort in 1, and OY in 2). This is an unstable situation since $AP_1 > AP_2$. Fishermen are concerned with AP's since the fish they leave behind has no future value to them. Therefore, they maximize catch today. Fishing effort will leave area 2 to fish area 1 until $AP_1 = AP_2$.

Given the price of fish to be constant, then $AR_1 = AR_2$. Given a linear cost function, the $AC_1 = AC_2$. Suppose area 2 is the extensive margin of fishing, then all that will be recovered is outlay costs plus opportunity costs (i.e. $AR_2 = AC_2$). This implies $TR_2 = TC_2$. It also follows that $AR_1 = AC_1$ and $TR_1 = TC_1$. Thus for the fishery as a whole, to obtain a stable solution TR = TC is required.

[9]Anthony Scott, Natural Resources: The Economics of Conservation (Toronto, MacLelland and Stewart, 1973), pp. 172-178.

[10]By limiting effort to at least the maximum sustainable yield level, the possibility of external diseconomies from over-fishing is eliminated. Also, if the aim of fishing regulations is to maximize profits from the fishery (as opposed to maximizing employment), then effort would be restricted to OQ.

[11]W. J. Bruce, Limnological Study of Lobstick and Sangrit Lakes (Series No. NEW I - 75-4, Environment Canada, 1975).

[12]They are Lake Whitefish, Longnose Sucker, Lake Trout, Round Whitefish, Northern Pike, Burbot, Brook Trout, Common Sucker, and Ouananiche.

[13]Markets are already established for Lake Whitefish from fisheries in Manitoba, Alberta, Saskatchewan, and the North West Territories.

[14]George Nikolski, Theory of Fish Population Dynamics, (Edinburgh, Oliver and Boyd, 1969), pp. 176-177, 268. The reproductive capacity of older fish is less than that of young fish.

[15]John Piper, Red Paper on the Commercial Fishing Industry in Saskatchewan, Volume I, 2. (Released through the office of John Richards, MLA, Saskatoon University, 1974). This is comparable to the Northern Saskatchewan fishery where each group of fishermen uses over 1200 meters of netting per day.

CHAPTER IV

COST BENEFIT ANALYSIS

Introduction

This chapter deals with the economic evaluation of the fishing project. The project will be viewed from three different aggregates. The costs and benefits will be ascribed to the government (provincial and federal), the Indians, and the economy as a whole.[1]

The governments' purpose in initiating the project is a redistribution of income to a relatively "poorer" sector of society through job creating programs. The analysis will try to determine whether or not the economic benefits outweigh the economic costs of redistributing income to the Indians through job creating programs. Possible indirect costs and benefits are discussed but are dismissed as insignificant.

4:1 Cost Benefit Analysis[2]

Cost benefit analysis is used to determine the economic effects of a given project and compare the project with other alternative projects.

Cost benefit analysis (henceforth CBA) as it has been traditionally applied, is a partial equilibrium tool.

The project analyzed usually affects a certain region or sector of the economy but is assumed to leave the rest of the economy virtually unaffected. CBA compares an agency's gains in welfare (benefits) to the agency's sacrifices (costs) to achieve those gains. An agency could be either an individual, a government, a region, or society in general. The determination of these benefits and costs are often times difficult and may vary from one agency to another. In any given project costs and benefits can be real or pecuniary. Real costs and benefits result from increased total welfare whereas pecuniary costs and benefits reflect changes in relative prices which redistribute rather than augment welfare. Real costs and benefits can be either direct or indirect. Direct costs and benefits are directly attributable to the establishment of the project, whereas indirect costs and benefits are induced by or stem from the project.

For example, a direct benefit from an irrigation project would be the increased farm output whereas an indirect benefit would be reduced soil erosion. A pecuniary benefit would be any increase in relative prices of farm equipment which would be offset by the consumers of farm equipment who have to pay the higher prices. A pecuniary benefit is not a net gain to society.

There has been some controversy as to the extent that pecuniary and indirect costs and benefits be included in any CBA. Sewell, et al. suggest that pecuniary and indirect costs and benefits mainly affect those individuals associated with the project and leaves the rest of society unaffected.[3] Thus, from a national scope pecuniary and indirect costs and benefits will not have any influence.

For any given project an estimate of its extended life can usually be made and the costs and benefits that accrue can be separated into which year they will occur. It will not be sufficient, however, to simply sum the total costs and benefits over time. Given uncertainty of the future, individuals prefer consumption today rather than consumption in the future. Thus, the costs and benefits occurring in year t should be weighted more heavily than costs and benefits in year $t + 1$ which in turn should be weighted more heavily than costs and benefits in year $t + 2$, and so on. The problem is dealt with by finding the present value of future costs and benefits. The procedure involves using a certain discount rate on the costs and benefits.

There are various views as to the selection of the discount rate. One view is that the discount rate should reflect the time preference of individuals.

Individuals prefer consumption today rather than consumption in the future because the future consumption goods may not materialize or the individual may not be present to benefit from them (uncertainty of the future). The discount rate should reflect the preferences of individuals for consumption over time and it has been approximated by the rate of return of risk free investments.

However, the time preferences of individuals may not be their preferences as a collective agent because individuals are more uncertain as to their future than society. Thus, a social time preference rate lower than the private rate should be used. Also saving for the future is a public good, and the government, as guardian of present and future generations, should encourage investment today to provide for future generations. This would tend to lower the discount rate even further. However, if future generations attain higher levels of welfare through investment today, then the marginal utility of consumption for future generations will be less than that of the present generation; thus gains to future generations will have to be discounted to reflect the differences in marginal utilities. This will tend to raise the social time preference rate. But will future generations have higher levels of welfare than the present

generation? Environmental pollution may leave future generations on lower levels of welfare than the present. This would tend to lower the social time preference rate, again.

Another approach to the selection of the discount rate is the use of the opportunity cost of public funds. Public investment will involve the sacrifice of some other investment from the private sector. Therefore, if public investments are not to reduce the national output they should yield a rate of return at least as high as the rate it could have received in the private sector. Thus, only if a public project yields net benefits greater than zero when discounted at the private opportunity cost rate should it be undertaken.

In perfect capital markets each of the above three rates will be equal. However, imperfections in capital markets can cause divergencies in the rates.

Differences in risk cause many different rates of return to be observed in capital markets. Since public projects tend to be low risk because of risk pooling and spreading of investment, a rate of return from a similar low-risk investment in the private sector should be used as the discount rate. Any form of taxation, for example, will cause private yields to be lower than gross yields on investments. Thus, in order to obtain an after tax

yield of r per cent, the private rate of return will have to be greater than r per cent. Differences in the tax rates of individuals and corporations also contribute to different rates of return being observed. The tax rate for most individuals is much lower than the rate for corporations, therefore individuals would require a lower gross rate of return than corporations. Also, if external effects are not reflected through capital markets, then the private opportunity cost rate would be appropriate.

Given these divergences in the various rates, which rate should be used to evaluate a public investment? Dasgupta and Pearce suggest that the choice depends on the source of the funds used.[4] They argue that the funds raised through taxation (reduced consumption in the private sector) should be discounted at the social time preference rate and the funds raised through government borrowing (reduced investment in the private sector) should be discounted at the private opportunity cost rate.[5] Mishan says, however, that even if the funds were raised through taxation, they can be reinvested in the private sector and earn the private rate of return; thus the appropriate rate is the private opportunity cost rate.[6] In the case in which there are political constraints (the funds cannot be reinvested in the private sector)

and the funds have to be used for a public project, then the governments' rate is appropriate.[7] The funds used in this project cannot be reinvested in the private sector, thus the rate which the government presently used for evaluating its projects, 10 per cent, will be used for this project.

However, there is no indication of how the governments' rate of 10 per cent is decided. If, for example, the government is undertaking any project that gives positive net benefits when discounted at 10 per cent, and the appropriate social rate is greater than 10 per cent, then too much public investment would be undertaken. If, on the other hand, the appropriate social discount rate is less than 10 per cent then too little public investment will be undertaken. Also, if the rate of 10 per cent is an average rate of return for all government departments (one department may have a rate of return of 20 per cent, another 5 per cent, but the average is 10 per cent), then a serious misallocation of resources within the public sector will take place. The department whose rate of return is 20 per cent will undertake too little investment, whereas the department whose rate is 5 per cent will undertake too much investment. The appropriateness of the 10 per cent discount rate depends on the criteria used by the governments in selecting the rate and not on the use of

the governments' rate.

When the discount rate is decided, and the present value of costs and benefits determined, the remaining problem is to decide which measure of evaluation is best for comparison with other projects. This thesis will not rank this project against alternatives because at present there is only one alternative (total acculturation of the native through education) and data have not been sufficiently documented to provide a comparison.

Since this project will not be ranked against alternatives, the only decision to be made is whether or not to undertake the project. If, at the government's discount rate, benefits exceed costs for the project, then the government should undertake this investment. Two methods of evaluation will be given:

(1) net benefits which give the net gain to society, and

(2) benefit cost ratio which gives a rate of return for the project.

4:2 CBA of the Fishery

CBA is used to access the economic feasibility of a project. However, a project is a means to achieve a purpose. The project analyzed here is a commercial fishing venture for the Montagnais Indians of Labrador. The

purpose of the project is to achieve long term employment for the Indians who are presently receiving social assistance and have little hope of obtaining employment elsewhere.

There are alternative methods of achieving the above purpose. They are, as Gerhard Anders points out, the complete acculturation of the natives or a continued existence of communities in their traditional mode of existence.[8] Complete acculturation of the natives to "western" society would involve extensive education and job retaining programs. This would likely involve a tremendous amount of capital. The other method is to allow the natives to exist in their old traditional forms of hunting, fishing, and trapping. The Montagnais Indians have chosen to opt for the latter method. Anders points out, however, that for the majority of natives complete acculturation is necessary. For small numbers, resource projects, like the one described here, may suffice.[9]

As described in Chapter II, the project is a joint venture of Canada Manpower, the provincial government of Newfoundland, and the IBC. The provincial government will provide funds for the capital equipment necessary for the fishery. Canada Manpower will provide

additional funds for salaries for a period of four years. Six fishermen will fish the first season with the possibility that more fishermen can be added in later years.

For the purpose of this analysis the time horizon of the project will be four years. After four years the Indians no longer receive salaries from Canada Manpower and will either be willing to get paid from revenues or the fishery will end. If the project proves successful for six fishermen over four years (benefits exceed costs) then it would warrant an increase in fishermen in further years. The increase in the number of fishermen is arbitrary, but for this analysis the increase will be six fishermen per year. Thus, for the second year there will be twelve fishermen, for the third year eighteen fishermen, and for the fourth year twenty-four fishermen. If for the last six fishermen added benefits exceed costs for all three of the agencies involved, then a further increase would be warranted until for any one of the agencies the marginal benefits of adding an extra fisherman equals the cost of adding that fisherman. However, the number of fishermen cannot be allowed to exceed the maximum sustainable yield level of thirty-two (see Chapter III). Thus, the cutoff point for additional fishermen will be whichever occurs first: the maximum sustainable yield level or net benefits of zero for any one of the

agencies for the marginal fisherman.

4:21 Direct Costs Incurred by the Governments[10]

A major expense in establishing a fishery is the equipment to be used. The fishermen at Churchill Falls will be using freighter canoes powered by gas motors. The cost of each unit (boat and motor) is $1,500.00. There are six fishermen and they will fish in groups of two, so three units will be needed. The total cost will be $4,500.00. The provincial government is also supplying 30 nets at $100.00 each. Seven tents are needed for living quarters (six fishermen and one co-ordinator). The total cost of the seven tents is $1,400.00. $2,000.00 has also been allocated for radio equipment of various kinds (e.g. shortwave). The campsite at Lobstick is approximately 108 km. from Churchill Falls, therefore some form of transportation is necessary to move fish, for food supplies and health services. The provincial government has allocated $6,000.00 for a pick-up truck. Perhaps the single most important cost is the cooling units which are to be installed at the site. These cooling units hold the fish produce until it is shipped to markets. Two units will be installed, the total cost of which is $17,000.00. This is the extent of the capital equipment

that the provincial government will supply. The purchase of this capital equipment is assumed to be made in year zero of the analysis. The project will start in year one. The equipment will be depreciated (declining balance) at a rate of 10 per cent.[11] The scrap value remaining after the four-year time horizon of the project is an asset of the project.[12] Thus, the actual cost of equipment will be the initial outlay in year 0 (zero) less the discounted scrap value in year 4.

The total equipment purchased was:

3	freighter canoes with engines	$ 4,500
30	nets	3,000
7	tents	1,400
	Radio equipment	2,000
	Pick-up truck	6,000
2	cooling units	17,000
	Total	33,900

At a depreciation rate of 10 per cent, after four years the scrap value is:

Year 0	$33,900
Year 1	3,390
Year 2	3,051
Year 3	2,746
Year 4	2,471
Scrap Value	$22,242

Another cost incurred by the provincial government is that of transporting the fishermen from North West River to Churchill Falls. This cost will be incurred only once per fisherman since the Indians have decided to trap and hunt in the area during the off season. The provincial government has allocated $3,000.00 for transportation costs.

Under the LEAP agreement the fishermen and the co-ordinator will be paid on a weekly basis. They will not be paid out of the revenues received from fish production. These salaries are therefore treated as an expense of establishing the fishery.[13] Each fisherman will receive $125,00 per week and the co-ordinator $250.00 per week. The salaries amount to $125 x 6 x 18 = $13,500.00 (the length to the season is 18 weeks). The co-ordinator will receive $4,500.00 for this period. The total salaries paid out are $18,000.00 per season. The agreement between

LEAP and the IBC also includes $3,500.00 per season to be treated as other expenses. These other expenses cover operating and maintainance costs of the equipment. The total LEAP expenditure is $21,500.00 per season. This concludes the direct costs involved in establishing the fishery.[14]

These costs have to be discounted to determine their present value. The choice of using 10 per cent as the discount rate was made earlier in this chapter.

The above costs can be broken down per year. The costs are shown in Table I, (all Tables are given in the appendix). The analysis is based in year zero. Thus the present value formula is:

$$PVC = \sum_{i=0}^{4} \frac{Ci}{(1+r)} \; i$$

where Ci is the cost in year i and r is the discount rate of of 0.10

PVC = $104,779.00

4:22 Direct Costs Incurred by the Indians

The Indians who will be participating in the fishery are presently unemployed and receiving financial assistance from the government. The only cost incurred by the Indians to participate in the fishery is the welfare payments they will have to forego. In Chapter II

it was assumed that by hunting and trapping during the off season, the Indians would not be eligible for welfare payments when they are not fishing. These welfare payments, according to the provincial government, amount to $4,512.00 per year for a family unit.[15] There are a total of seven family units involved in the project, therefore, the cost to the Indians is $31,584.00 annually. See Table II. The present value of these costs is $100,117.00.

4.23 Direct Costs to the Economy

Direct costs to the economy are those expenditures that are prerequisite to the establishment of a fishery at Churchill Falls. The cost of equipment is such an expense. The actual cost of using the equipment is the outlay cost in year zero less the discounted scrap value in year 4. The cost of transporting the fishermen to the site is also an expense to the economy.

LEAP provides $21,500.00 per year. $3,500.00 is to cover operating expenses and is a cost to the economy of fishing. The payment of $18,000.00 per year in salaries may not be considered a cost to the economy. If the Indians would not be fishing in the reservoir without the payment of salaries, then the salaries can be considered an expense. If, however, the Indians would

agree to fish without the payment of salaries (i.e. the salaries are not required to produce output), then the salaries are mere transfer payments. In the absence of any statement to the contrary, the view is taken that the Indians would not fish without the payment of salaries. The salaries are, thus, a cost to the economy of establishing the project. The costs to the economy are the same as those to the government. See Table III. The present value of these costs is $104,779.00.[16]

4:24 Direct Benefits to the Government

The increased output (revenues from fish production) from the project accrues entirely to the Indians involved in the fishery (see Chapter II) and not to the governments, hence, the increased output is not a benefit to the governments. Thus, the only benefit accruing to the governments is the saving in welfare payments that would have been paid to the fishermen and co-ordinator. The welfare payments were determined to be $31,584.00 annually.[17]

At the end of the fourth year the scrap value of the equipment becomes an asset to the government. The value of the equipment after the fourth year was determined to be $22,242.00. The benefits per year are given in

Table I. The formula used is:

$$PVB = \sum_{i=0}^{4} \frac{Bi}{(i+r)} i$$

where Bi is benefits in year i and r is the discount rate of 0.10.

The present value of these benefits is $115,308.

4:25 Direct Benefits to the Indians

The direct benefits accruing to the Indians are twofold. Part of the benefits to the Indians is the salaries they receive. The salaries amount to $18,000 per year. The $3,500.00 that LEAP provides as other expenses (operating expenses) are not classed as benefits because they do not accrue to the Indians.

Another benefit that can accrue to the Indians is the revenues from fish production. From the previous chapter a group of two fishermen are expected to be able to catch a total of 27,655 kg. per season. There are three groups of fishermen, therefore the total catch per season will be 82,966 kg.

The average price paid to fishermen for whitefish from January to August 1975 was $1.10 / kg.[18] This is the price which will be used in determining

revenues from fish production at Churchill Falls.[19] The increase in supply of freshwater fish from the Churchill Falls fishery is not expected to induce any significant change in prices. The maximum sustainable yield to be taken form Churchill Falls is 454,000 kg., whereas the total Canadian freshwater fish production in 1972 amounted to over 42 million kg.[20] Thus, the price quoted will be expected to hold and the total revenues per season from fish production will be $91,263.00. The benefits are given in Table II. The present value of the benefits is $357,433.00.

4:26 Direct Benefits to the Economy

The direct benefit that accrues to the economy is the increase in output from the project (the revenues from fish production).[21] The welfare payments that were a saving to the governments, is just a transfer of income from one sector to another for the economy and thus, is not a social benefit when distribution is ignored.

The revenues received from fish production were determined to be $91,263.00 annually. The remaining value of the capital equipment after the fourth year is also an asset to the economy. See Table III. The present value of these benefits is $311,313.00.

4:27 Evaluation of Indirect Costs and Benefits

Indirect costs and benefits stem from or are induced by the establishment of a project. Perhaps the most important indirect effect of the project is the redistribution of income. Earlier, it was noted that a reason for discounting future benefits (and costs) was because they would accrue to a richer generation. The same can be said for benefits accruing today to different sectors of society; benefits accruing to the Indians could be weighted more heavily than benefits accruing to other "richer" groups in society. The respective marginal utilities of income would be appropriate weights to assign but they are impossible to measure. Attempts have been made to utilize the marginal personal income tax rates as proxies for the appropriate weights,[22] however, for this analysis the weights assigned to the benefits accruing to the Indians are no different than had the benefits accrued to other members of society.

Another indirect effect that is sometimes important in fishing projects is the trade-off between sports and commercial fishing. This trade-off is one of the major focal points of Piper's Red Paper on the Saskatchewan fishing industry.[23] In Northern Saskatchewan sport fishing is big and there are many fishing

lodges that cater to the North American fishing enthusiast. In Northern Saskatchewan there is an opportunity cost of establishing a fishery in terms of sport fishing revenues, but in Labrador this is not the case. The Churchill Falls fishery will not have to compete with fishing lodges for revenues because there are no fishing lodges in the area and indeed it will be difficult to establish any lodges without the consent of CFLCO who, under the BRINCO agreement, still controls water rights in the area. Also, the sport fishing enjoyed by the townspeople of Churchill Falls will not be affected. The main sport fish in the area is Brook Trout which according to Environment Canada have been found in the Jacopie Lake region (see Fig. 2), but are very rare in the rest of the reservoir.

Pollution is usually a main cause of concern in many natural resource projects. In a fishery pollution can result from the disposal of wastes during processing. In Churchill Falls there will be no fixed processing facility. The fish will be gutted immediately upon capture and the remains dispersed throughout the reservoir. In the reservoir these remains constitute part of the natural recycling process. The gutted fish will then be stored in the cooling units until shipping. These

cooling units are for storage purposes only, and will not emit the wastes that a processing facility would.

A very important indirect benefit from the establishment of the fishing project is the possible enhancement of the Indian's human capital. Involvement in this fishing project gives the Indian not only a future income stream but maybe a chance to sell his newly found work ethic and increased skills at a higher price elsewhere in the economy. This would increase the employment opportunities available to the Indians who are fishing.[24]

4:28 Comparison of Costs and Benefits

For the governments the present value of benefits is $115,308.00 while the present value of costs is $104,779. This is a benefit cost ratio of 1.1:1 and net benefits of $10,529.00.

For the Indians and the economy, the benefits are dependent upon the success in fishing. If the assumptions as to catch are valid, net benefits are quite substantial and the benefit cost ratio high. For the Indians the benefit cost ratio is 3.57:1 and net benefits are $257,316.00. For the economy the benefit cost ratio is 2.97:1 and net benefits are $206,534.00. As

the project for the initial group is projected to be successful it is expected that the number of fishermen would be increased in subsequent years.

4:29 Increase in the Number of Fishermen

If the number of fishermen is doubled for the second year of the project, making the total twelve, the six fishermen added during the second year can be expected to require the same costs as the six original fishermen. The benefits can also be expected to remain the same. The difference between the two groups is that the time horizon for the second year group is three years. The costs and benefits per year for the second group of fishermen are given in Tables IV, V, and VI. Benefits exceed costs for the government, the Indians, and the economy.

The number of fishermen can be increased by six for the third year. Again costs and benefits are expected to be linear but the time horizon will be two years. The costs and benefits are given in Tables VII, VIII, and IX. Benefits still exceed costs for all three agencies, so the number of fishermen can be increased by six for the fourth year. The costs and benefits for the last six fishermen are given in Tables X, XI, and XII.

At the end of the fourth year the payment of salaries by LEAP ends. The fishermen then receive salaries according to their revenue productivity. The major expenses of establishing the fishery will have been made and the fishermen will now be in a position to continue the fishery without financial support from public funds. The present value of the possible accumulated capital (fishing revenue) after four years is $688,984.00. This is sufficient capital to provide the fishermen with equity to improve their fishing technology.[25]

The total costs and benefits for the four years are given in Tables XIII, XIV, and XV.

For the government the benefit cost ratio is 1.09:1 and net benefits are $27,578. For the Indians the benefit cost ratio is 3.45:1 and net benefits are $586,321.00. For the economy the benefit cost ratio is 2.6:1 and net benefits are $470,522.00. Clearly, the program should be successful in terms of net benefits to the Indians. Although using public funds to provide employment, the government, in this particular case, is conserving the public sector's resources while substantially benefiting the economy.

The total number of fishermen is twenty-four. The maximum sustainable yield level (from Chapter III)

would support thirty-two. It appears as if an increase of a further eight fishermen is warranted. This may not be the case, however. The maximum sustainable yield level was based on the assumed state of fishing technology remaining unchanged. This assumption may not be reasonable. As fishermen become more familiar with the reservoir, they attain better knowledge of the best fishing areas. A better knowledge of fishing areas could lead to a greater catch per unit effort than Environment Canada recorded. Also, any new innovation will increase catch. For example, if a mechanical hauler permits 20 nets per day to be hauled instead of 10 nets, then total catch will increase. The catches can easily be monitored by reviewing the statistics of the coordinator. In this manner, corrective action such as further restriction on fishermen or the shortening of the season can be taken before overfishing occurs.

The choice of increasing effort by six fishermen each year is arbitrary but has merit. If the project began with twenty-four fishermen, the provincial government may not have the facility and experience to market 340,000 kg. of fish. The gradual build-up of total catch from almost 83,000 kg. to 340,000 kg.

over four years gives the provincial government time to establish the product, secure markets for future years, and familiarize themselves with the marketing operation.

4:3 Summary

The above analysis shows that neither the government, nor the Indians, nor the economy will lose (costs greater than benefits) in the establishment of this fishing project. This analysis, however, was based on the assumption that the Indians do have fish catches totalling 27,600 kg. per season per group and that the price paid to the fishermen was $1.10/kg. There are possibilities that these assumptions do not hold and if they do not, the analysis will be inaccurate. Those possibilities are examined in the following chapter.

CHAPTER IV

FOOTNOTES

[1]This format was patterned after that used by Michael Borus, "A Benefit Cost Analysis of the Economic Effectiveness of Retraining the Unemployed" in Yale Economic Essays (1963-64), pp. 370-429.

[2]This summary of cost-benefit analysis is based on the following: A. K. Dasgupta and D. W. Pearce, Cost-Benefit Analysis: Theory and Practice (London, MacMillan Press, Ltd., 1972); W. R. D. Sewell, John Davis, A. D. Scott, and D. W. Ross, Guide to Cost Benefit Analysis (Ottawa, Queen's Printer 1961); E. J. Mishen, Cost Benefit Analysis (London, George Allen and Unwin, Ltd., 1973); R. Musgrave and P. Musgrave, Public Finance in Theory and Practice (New York, McGraw-Hill, Inc., 1973) and J. Burkhead and J. Miner, Public Expenditure (Chicago, Aldine Atherton, Inc., 1971).

[3]Sewell, et al., Guide to CBA, pp. 18-19.

[4]Dasgupta and Pearce, CBA, pp. 154.

[5]Stephen Marglin. Public Investment Criteria (Cambridge, M.I.T. Press, 1967) pp. 58-61 and Arnold Harberger, Project Evaluation (London, MacMillan Press, Ltd., 1972) pp. 95-102, have both tried to estimate a combination of the two rates using different proxies, to discount public projects.

[6]Mishan, CBA, pp. 224.

[7]Ibid., pp. 724.

[8]Anders, Economic Development, pp. 66-67.

[9]Ibid., pp. 66.

[10]The estimate of the cost of capital equipment has been supplied through the courtesy of Labrador Services, Department of Rehabilitation and Recreation, Government of Newfoundland and Labrador.

[11]This is the rate which the Department of Indian Affairs and Northern Development used in similar studies for such equipment.

[12]If the original six fishermen continue to fish after four years then the depreciation rate will continue until the equipment's life has expired. The total depreciation of the equipment will be a cost incurred by the governments. But whether the fishery continues or not, after four years the equipment has a certain retained value and that value is an asset to the government.

[13]The money provided by LEAP does not have to be a cost of establishing the fishery. The money is provided by an agreement between LEAP and the IBC. Theoretically, the fishermen could have been paid according to their marginal products. However, the money is being provided out of public funds and it will be treated as an expense of establishing the fishing project.

[14]The impact of the project on any possible resource misallocation can safely be assumed to be negligible.

[15]These are the actual cash payments to an average family at North West River.

[16]If the Indians would fish without the payment of salaries (opportunity cost of labour is zero), then the present value of costs is $47,722.00.

[17]Any further assistance such as subsidized housing cannot be considered a saving. If the government has provided houses under their assistance plan, the cost of the house has already been met and regardless if the houses are occupied or not there is no further saving to the government.

[18]Statistics Canada, Monthly Review of Canadian Fisheries Statistics, September, 1975. This is the price to be paid to the fishermen. The price to the fishermen shows a steady increase over the last 15 years. The $1.10/kg. appears consistent with that trend and is not an abnormal or temporary high or low.

[19]The total catch will not consist entirely of whitefish. Approximately 60 per cent of the catch will be whitefish, 31 per cent lake trout, and 9 per cent other species. The price for lake trout is only slightly higher than that of whitefish while prices of other species were not available. By using the price per kilogram for whitefish as a base, the effect may be a slight underestimate of revenues.

[20]Statistics Canada, Fisheries Statistics. The Canadian totals for whitefish in 1973 were a little under 9 million kg. However, it appears unlikely that there is any differentiation of product on behalf of the consumer (that is, the consumer demands freshwater fish, not a certain species). The appropriate supply is the total freshwater fish production and not whitefish production.

[21]The increase in total output is usually measured in terms of market prices. Lacking sufficient information to determine otherwise, it is assumed, that the provincial government will at least break even in the marketing process and cover all its expenses. Thus, the net increase in total output in the economy is assumed to be accurately reflected through the revenues paid to the fishermen.

[22]Otto Eckstein, "A Summary of the Theory of Public Finance Expenditure Criteria" in National Bureau of Economic Research, Public Finance: Needs, Sources, and Utilization (Princeton, Princeton University Press, 1961), pp. 447-448.

[23]Piper, Red Paper, pp. 16-18.

[24]If any of the fishermen decided that their newly found work ethic or skills could provide them with employment elsewhere, then another member of the Indian Band at North West River could replace him in the project.

[25]Under the agreement with LEAP, Labrador Services, and the IBC, the revenues received from the fishery (for the four years it is being funded) will be used to enable the Indians to continue the fishing after four years. This may mean the replacing of old equipment and the possible purchase of new equipment to improve fishing technology.

CHAPTER V

CONCLUSIONS AND POLICY RECOMMENDATIONS

Introduction

The preceding chapters analyzed a specific government project designed to create employment for the native people of Labrador. Chapter II presented the historical background of the natives of Labrador and outlined the reasons for the widespread unemployment among the natives. It also described the fishing project that the governments are establishing in conjunction with the IBC. Chapter III discussed some of the technical problems of the project while Chapter IV gave a CBA of the project.

The major finding of the preceding chapters is that the fishing project, as it is now set up, has the potential to create long-term employment for 28 natives. Including the families, the total number of natives affected is approximately 168.[1] The project can provide net benefits of $586,321.00 to the Indians, $27,578.00 to the governments, and $470,522.00 to the economy.

These figures are dependent upon a number of assumptions. This chapter examines the sensitivity of the results to modifications of the assumptions and provides recommendations for future projects of this nature.

5:1 Sensitivity Analysis

The aforementioned analysis is contingent upon two main assumptions:

1. The Indians operate at the level of effort assumed, that is, they record the same catch per unit effort as Environment Canada, they fish with 1365 meters of netting per day, and they fish 108 days per season.
2. The provincial government can establish markets for the fish and cover all its costs in marketing the fish.

There are possibilities that these assumptions will not hold. The Indians may be negligent in their fishing effort or the government may be inefficient in its marketing. If either of the above assumptions does not hold, the benefits estimated will be grossly inaccurate. The costs, however, will only vary in the case of poor

marketing by the provincial government. Any loss incurred by the provincial government would affect the net benefits for the governments and the economy.

There are three variables in assumption one: the catch per unit effort, the amount of netting fished, and the number of days fished. The probability of the Indians attaining the catch per unit effort of Environment Canada is approximately one since the catch per unit effort of Environment Canada was calculated from a series of random settings throughout the lake. It was assumed that 1365 meters of netting is fished. It is actually 10 nets of 136.5 meters each.[2] If the Indians do fish, then the probability that they fish the full 10 nets can vary from zero to one. There are ten different possibilities (one net or ten nets) and each has its own determinants of the probability of occurrence. The expected value of this probability function determines the expected amount of netting fished. The probability that the Indians fish the full 108 days of the season can vary from zero to one. There are 109 different possibilities of fishing intensity (0 days to 108 days) and, again, each combination has its own determinants of the probability of occurrence. The expected

value of this probability function determines the expected intensity of fishing by the Indians (the expected number of days fished). The catch per fishing group is thus determined by the catch per unit effort, the expected amount of netting fished, and the expected number of days fished.[3] The determination of probability functions presupposes data on which to base these distributions. To obtain probabilities would entail a socio-economic analysis of the Montagnais work habits and incentives. Such a study does not exist. There have been many studies on the work habits of various Indian bands, but the extent to which they can be generalized is limited because of the many differences in Indian bands. To extrapolate from another study to the Montagnais may do them an injustice. There is no information to suggest the results would be the same.

Assumption two says that the provincial government can cover the costs involved in marketing. Again, there is insufficient data to suggest that assumption two has a given probability of holding. Whether or not the government does recover its costs depends entirely on its efficiency in marketing the fish produce. John Piper points out that the Freshwater

Fish Marketing Corporation (of Western Canada) lost an enormous sum of money under a certain management, however, when management was changed the Corporation did indeed break even.[4] If the government does indeed cover more than their costs, then there is an extra benefit to the governments (a windfall gain) and to the economy (since market prices are higher than was assumed). If, however, the provincial government cannot recover all the costs of marketing, then there is an increased cost to the governments (the loss involved in marketing which can be classed as a price subsidy to the Indians) and a reduction in benefits of the project to the economy (market prices will be lower than assumed). It should be emphasized that whether or not the provincial government will break even in marketing the fish depends entirely upon its own efficiency in marketing (assuming supply and demand conditions remain unchanged).

Thus, there are three variables whose probabilities are indeterminate; (1) will the Indians fish 1365 meters of netting per day, (2) will they fish 108 days, and (3) can the government recover all its costs. There is an infinite combination of these variables and

to examine the effects of different combinations would add nothing to the decision-makers valuation of any one variable.

5:2 Policy Recommendations

As the project is designed now, the probability of the cost occurring is one. This project, and future projects of this type, can be designed such that the costs to the government can largely be recovered and the costs to the economy can be greatly reduced. The redesigned project would not affect benefits to the above agencies. The cost to the Indians, however, would increase. The government could provide the Indians with loans, at appropriate interest rates, to purchase equipment and to cover starting costs. This will shift cost from the government to the Indians. Also, the fishermen could be paid from the revenues received from fish production rather than by salaries. This would be a decrease in cost for both the government and the economy.[5] If the project were designed in this manner, then the probability of the costs occurring would depend on the probability of the Indians' fishing intensity and the government recovering

marketing costs. The Indians, if paid from revenues from fish production, would be provided with incentive to fish at the assumed intensity, and as a result further increase their human resource potential.

5:3 Conclusions

The governments' (federal and provincial) purpose in funding this fishing project was to increase employment among the Indians of North West River. This can be accomplished through the fishing project. The project if redesigned in the above manner would still serve as a tool to increase employment among the Indians but, more importantly, it could do so more efficiently. The redesigned project would still provide net benefits to the Indians and, could increase the probability of success by providing the Indians with work and incentive.

Thus, it is the recommendation of this thesis that future projects of the above nature should place more emphasis on providing the Indians with greater individual incentives (increasing the probability of success) rather than emphasizing the redistributional

aspects as is evidenced by this particular fishing project.

CHAPTER V

FOOTNOTES

[1]According to the provincial government the average family size at North West River is six. Each of the 28 people involved in the fishing can be classed as family heads, thus the total number of natives affected is approximately 168.

[2]It would be physically unreasonable to expect the Indians to fish more than ten nets per day.

[3]It should be noted that even though the probability of days fished are determined by the character of the Indians themselves (work habits and incentive), each decision is independent of the other. That is, the Indians make a decision as to the number of days fished and an independent decison as to amount of netting fished.

[4]Piper, Red Paper, pp. 45-46.

[5]The money paid in salaries by LEAP is $18,000.00 annually. These salaries will no longer be paid to the fishermen. This seems to be a definite decrease in cost to the government and the economy. However, an explanation is required. The assumption was made that the $18,000.00 in salaries paid to the Indians did not represent a transfer payment because the Indians, oblivious of the revenues that could be earned, would not fish without the salaries. Given a new informational space, the salaries would not be necessary for the Indians to participate in the project. The Indians now know that the revenues that can be earned from fishing is more than enough to cover the costs incurred in establishing the fishery.

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REFERENCE TABLES

CHAPTER IV

TABLE I

COSTS AND BENEFITS TO THE GOVERNMENT
FOR THE FIRST SIX FISHERMEN*

Year		$Costs		$Benefits
0	Equipment	33,900		0
	Total	33,900		
1	LEAP Money	21,500	Welfare Saving	31,584
	Transportation	3,000	Total	31,584
	Total	24,500		
2	LEAP	21,500	Welfare Saving	31,584
	Total	21,500	Total	31,584
3	LEAP	21,500	Welfare Saving	31,584
	Total	21,500	Total	31,584
4	LEAP	21,500	Welfare Saving	31,584
	Total	21,500	Scrap Values	22,242

$$PVC = \sum_{i=0}^{4} \frac{Ci}{(1+r)^i} = \$104,779 \qquad PVB = \sum_{i=0}^{4} \frac{Bi}{(1+r)^i} = \$115,308$$

$$\frac{PVB}{PVC} = \frac{\$115,308}{\$104,779} = \frac{1.1}{1} \qquad \text{net benefits} = \$10,529.$$

*These costs and benefits are for the six original fishermen who will fish the full four years.

TABLE II

COSTS AND BENEFITS TO THE INDIANS
FOR THE FIRST SIX FISHERMEN

Year		$ Costs		$ Benefits
0		0		0
1	Opportunity Cost	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263
2	OC	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263
3	OC	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263
4.	OC	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263

PVC = $100,117

PVB = $357,433

$$\frac{PVB}{PVC} = \frac{\$357,433}{\$100,117} = \frac{3.57}{1}$$

Net Benefits = PVB - PVC = $257,316

TABLE III

COSTS AND BENEFITS TO THE ECONOMY
FOR THE FIRST SIX FISHERMEN

Year		$ Costs		$ Benefits
0	Equipment	33,900		0
	Total	33,900		
1	LEAP	21,500	Revenues	91,263
	Transport.	3,000	Total	91,263
	Total	24,500		
2	LEAP	21,500	Revenues	91,263
	Total	21,500	Total	91,263
3	LEAP	21,500	Revenues	91,263
	Total	21,500	Total	91,263
4	LEAP	21,500	Revenues	91,263
	Total	21,500	Scrap Values	22,242
			Total	113,505

PVC = $104,779 PVB = $311,313

$\frac{PVB}{PVC} = \frac{\$311,313}{\$104,779} = \frac{2.97}{1}$ Net Benefits = $206,534

TABLE IV

COSTS AND BENEFITS TO THE GOVERNMENTS FOR THE SECOND GROUP*

Year		$ Costs		$ Benefits
0		0		0
1	Equipment	33,900		0
	Total	33,900		
2	LEAP	21,500	Welfare Saving	31,584
	Transport.	3,000	Total	31,584
	Total	24,500		
3	LEAP	21,500	Welfare Saving	31,584
	Total	21,500	Total	31,584
4	LEAP	21,500	Welfare Saving	31,584
	Total	21,500	Total	31,584

PVC = $81,904

PVB = $88,283

$$\frac{PVB}{PVC} = \frac{\$88,283}{\$81,904} = \frac{1.07}{1}$$

Net Benefits = $88,283-$81,904
= $6,379

*These are the costs and benefits for the six fishermen who will start in the second year of the project. These fishermen will fish for three project years.

TABLE V

COSTS AND BENEFITS TO THE INDIANS
FOR THE SECOND GROUP

Year		$ Costs		$ Benefits
0		0		0
1		0		0
2	Opportunity Cost	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263
3	OC	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263
4	OC	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263

PVC = $71,404 PVB = $247,019

$$\frac{PVB}{PVC} = \frac{\$247,019}{\$\ 71,404} = \frac{3.45}{1}$$

Net Benefits = PVB-PVC = $175,615

TABLE VI

COSTS AND BENEFITS TO THE ECONOMY
OF THE SECOND GROUP

Year		$ Costs		$ Benefits
0		0		0
1	Equipment	33,900		0
	Total	33,900		
2	LEAP	21,500	Revenues	91,263
	Transport.	3,000	Total	91,263
	Total	24,500		
3	LEAP	21,500	Revenues	91,263
	Total	21,500	Total	91,263
4	LEAP	21,500	Revenues	91,263
	Total	21,500	Scrap Values	24,713
			Total	115,976

PVC = $81,904 PVB = $223,204

$$\frac{PVB}{PVC} = \frac{\$223,204}{\$\ 81,904} = \frac{2.72}{1}$$

Net Benefits = $141,300

TABLE VII

COSTS AND BENEFITS TO THE GOVERNMENT FOR THE THIRD GROUP*

Year		$ Costs		$ Benefits
0		0		0
1		0		0
2	Equipment	33,900		0
	Total	33,900		
3	LEAP	21,500	Welfare Saving	31,584
	Transport.	3,000	Total	31,584
	Total	24,500		
4	LEAP	21,500	Welfare Saving	31,584
	Total	21,500	Scrap Values	27,549
			Total	59,044

PVC = $61,108 PVB = $64,057

$$\frac{PVB}{PVC} = \frac{\$64,057}{\$61,108} = \frac{1.04}{1}$$

Net Benefits = $2,949

*These are the costs and benefits for the six fishermen who will start in the third year of the project.

TABLE VIII

COSTS AND BENEFITS TO THE INDIANS
OF THE THIRD GROUP

Year		$ Costs		$ Benefits
0		0		0
1		0		0
2		0		0
3	Opportunity Cost	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263
4	OC	31,504	Revenues	91,263
	Total	31,504	Salaries	18,000
			Total	109,263

PVC = $45,301 PVB = $156,719

$$\frac{PVB}{PVC} = \frac{\$156,719}{\$\ 45,301} = \frac{3.45}{1}$$

Net Benefits = $111,418

TABLE IX

COSTS AND BENEFITS TO THE ECONOMY
FOR THE THIRD GROUP

Year		$ Costs		$ Benefits
0		0		0
1		0		0
2	Equipment	33,900		0
	Total	33,900		
3	LEAP	21,500	Revenues	91,263
	Transport.	3,000	Total	91,263
	Total	24,500		
4	LEAP	21,500	Revenues	91,263
	Total	21,500	Scrap Values	27,459
			Total	118,722

PVC = $61,108 PVB = $149,656

$$\frac{PVB}{PVC} = \frac{\$149,656}{\$\ 61.108} = \frac{2.44}{1}$$

Net Benefits = PVB-PVC = $88,548

TABLE X

COSTS AND BENEFITS TO THE GOVERNMENTS OF THE FOURTH GROUP

Year		$ Costs		$ Benefits
0		0		0
1		0		0
2		0		0
3	Equipment	33,900		0
	Total	33,900		
4	LEAP	21,500	Welfare Saving	31,584
	Transport.	3,000	Scrap Values	30,510
	Total	24,500	Total	62,094

PVC = $42,203 PVB = $42,411

$$\frac{PVB}{PVC} = \frac{\$42,411}{\$42,203} = \frac{1.004}{1}$$

Net Benefits = $208

TABLE XI

COSTS AND BENEFITS TO THE INDIANS
OF THE FOURTH GROUP

Year		$ Costs		$ Benefits
0		0		0
1		0		0
2		0		0
3		0		0
4	Opportunity Cost	31,584	Revenues	91,263
	Total	31,584	Salaries	18,000
			Total	109,263

PVC = $21,572 PVB = $74,628

$$\frac{PVB}{PVC} = \frac{\$74,628}{\$21,572} = \frac{3.45}{1}$$

Net Benefits = $53,056

TABLE XII

COSTS AND BENEFITS TO THE ECONOMY
FOR THE FOURTH GROUP

Year		$ Costs		$ Benefits
0		0		0
1		0		0
2		0		0
3	Equipment Costs	33,900		0
	Total	33,900		
4	LEAP	21,500	Revenues	91,263
	Transport.	3,000	Scrap Value	30,510
	Total	24,500	Total	121,773

PVC = $42,203 PVB = $83,172

$$\frac{PVB}{PVC} = \frac{\$83,172}{\$42,203} = \frac{1.92}{1}$$

Net Benefits = $40,969

TABLE XIII

TOTAL COSTS AND BENEFITS TO THE GOVERNMENTS FOR THE FOUR YEARS

Year		$Cost			$Benefits
0	Equipment	33,900	(1)*		0
	Total	33,900			
1	LEAP Trans.	24,500	(1)	Welfare Saving	31,584
	Equipment	33,900	(2)	Total	31,584
	Total	58,400			
2	LEAP	21,500	(1)	Welfare Saving	31,584
	LEAP & Trans	24,500	(2)	Welfare Saving	31,584
	Equipment	33,900	(3)	Total	63, 168
	Total	79,900			
3	LEAP	21,500	(1)	Welfare Saving	31,584
	LEAP	21,500	(2)	Welfare Saving	31,584
	LEAP & Trans.	24,500	(3)	Welfare Saving	31,584
	Equipment	33,900	(4)	Total	104, 752
	Total	101,400			
4	LEAP	21,500	(1)	Welfare Saving	31,584
	LEAP	21,500	(2)	Welfare Saving	31,584
	LEAP	21,500	(3)	Welfare Saving	31,584
	LEAP & Trans.	24,500	(4)	Welfare Saving	31,584
	Total	89,000		Total	109,924
				Total	231,263

PVC = $289,995 PVB = $317,572

$$\frac{PVB}{PVC} = \frac{\$317,572}{\$289,995} = \frac{1.09}{1}$$

Net Benefits = $27,578

*Denotes to which years fishing group costs and benefits can be attributed.

TABLE XIV

TOTAL COSTS AND BENEFITS TO THE INDIANS
FOR THE FOUR YEARS

Year		$ Costs			$ Benefits	
0		0			0	
1	Opportunity Costs	31,584	(1)*	Revenues and Salaries	109,263	(1)
	Total	31,584		Total	109,263	
2	OC	31,584	(1)	Rev. & Sal.	109,263	(1)
	OC	31,584	(2)	Rev. & Sal.	109,263	(2)
	Total	63,168	(3)	Rev. & Sal.	218,526	
3	OC	31,584	(1)	Rev. & Sal.	109,263	(1)
	OC	31,584	(2)	Rev, & Sal.	109,263	(2)
	OC	31,584	(3)	Rev. & Sal.	109,263	(3)
	Total	94,752		Total	327,789	
4	OC	31,584	(1)	Rev. & Sal.	109,263	(1)
	OC	31,584	(2)	Rev. & Sal.	109,263	(2)
	OC	31,584	(3)	Rev. & Sal.	109,263	(3)
	OC	31,584	(4)	Rev. & Sal.	109,263	(4)
	Total	126,336		Total	437,052	

PVC = $238,395 PVB = $824,716

$$\frac{PVB}{PVC} = \frac{\$824,716}{\$238,395} = \frac{3.45}{1}$$

Net Benefits = $586,321

*Denotes to which years fishing group costs and benefits can be attributed.

TABLE XV

TOTAL COSTS AND BENEFITS TO THE ECONOMY
FOR THE FOUR YEARS

Years		$ Costs			$ Benefits	
0	Equipment	33,900	(1)*		0	
	Total	33,900				
1	LEAP & Trans.	24,500	(1)	Revenues	91,263	(1)
	Equipment	33,900	(2)	Total	91,263	
	Total	58,400				
2	LEAP	21,500	(1)	Revenues	91,263	(1)
	LEAP & Trans.	24,500	(2)	Revenues	91,263	(2)
	Equipment	33,900	(3)	Total	18] 526	
	Total	79,900				
3	LEAP	21,500	(1)	Revenues	91,263	(1)
	LEAP	21,500	(2)	Revenues	91,263	(2)
	LEAP & Trans.	24,500	(3)	Revenues	91,263	(3)
	Equipment	33,900	(4)	Total	273,789	
	Total	101,400				
4	LEAP	21,500	(1)	Revenues	91,263	(1)
	LEAP	21,500	(2)	Revenues	91,263	(2)
	LEAP	21,500	(3)	Revenues	91,263	(3)
	LEAP & Trans.	24,500	(4)	Revenues	91,263	(4)
	Total	89,900			104,924	
				Total	469,976	

PVC = $289,995 PVB = $760,517

$\frac{PVB}{PVC} = \frac{\$760,517}{\$289,995} = \frac{2.6}{1}$

Net Benefits = $470,522

* Denotes to which years fishing group costs and benefits can be attributed.